THURSDAY, AUGUST 1, 1912.

MECHANICAL AND CHEMICAL ENGINEERING.

(1) *An Introduction to the Study of Fuel.* A text-book for those entering the Engineering, Chemical, and Technical Industries. By Dr. F. J. Brislee. (Outlines of Industrial Chemistry Series.) Pp. xxii + 269. (London: Constable and Co., Ltd., 1912.) Price 8*s.* 6*d.* net.

(2) *Diesel Engines for Land and Marine Work.* By A. P. Chalkley. With an introductory chapter by Dr. Rudolf Diesel. Pp. xi + 226. (London: Constable and Co., Ltd., 1912.) Price 8*s.* 6*d.* net.

(3) *Transactions of the American Institute of Chemical Engineers.* Volume iii, 1910. Pp. iv + 407. (New York: D. Van Nostrand Company, and Spon and Chamberlain; London: E. and F. N. Spon, Ltd., 1911.) Price 25*s.* net.

(4) *Reinforced Concrete Compression Member Diagram.* By Charles F. Marsh. (Diagram in case.) (London: Constable and Co., Ltd., n.d.) Price 3*s.* 6*d.* net.

(5) *Railway Signal Engineering (Mechanical).* By L. P. Lewis. (The Glasgow Text-books.) Pp. xviii + 358. (London: Constable and Co., Ltd., 1912.) Price 8*s.* net.

(1) THERE is scarcely any subject that repays scientific study better than that of the use (and abuse) of fuel, not only to the engineer and chemist, but to those who direct industries that consume fuel in one form or another. The profligate waste of our natural resources of fuel shows direct and melancholy evidence that the truths governing its utilisation are the property of a limited few, and that those who direct industries are only tardily learning that the trained chemist can teach many lessons of practical value. Such a volume as the one before us is to be welcomed, for though Dr. Brislee assumes technical knowledge on the part of the reader, it is no more than the elements of chemistry which those who control industries should possess or can command. Beginning with elementary chemical reactions, he shows how the equations of the chemist are not mere text-book conundrums, but the representation of actual changes taking place in every furnace, retort, and heat engine. He goes on to ascertain the weight of air necessary for the complete combustion of fuels of definite chemical composition, and chapter ii. makes this clear without unduly straining the reader's knowledge of elementary chemistry. The well-known methods of analysis are treated admirably, including the Orsat apparatus for determining the CO, CO_2 and O_2 in fuel and waste gases, also the delicate and somewhat troublesome explosion method for getting the H_2 and marsh gas content in fuel gases.

Calorimeters and pyrometers of various kinds on the market are described, but it would have been better if something more had been added regarding the degree of accuracy and sensitiveness expected from the various types. In correcting for the radiation losses in calorimeters of the "bomb" type, the Regnault-Stohmann formula is given. The more usual method is by plotting the time-temperature curves, which is only suggested by the author. Something more might also have been said about cooling curves in calibrating pyrometers. The correct calculation of the temperature of combustion, to which a chapter is devoted, depends upon our exact knowledge of C_p and C_v, the specific heats at constant pressure and temperature, and the author takes the linear laws, $C_p = a + bT$ and $C_v = a_1 + bT$, due to Chatelier and Mallard. These relations are known to be only approximate, and therefore the temperatures are subject to some degree of uncertainty in consequence. The effect of excess air on the temperature is of great importance, and as most boiler furnaces introduce an enormous amount of excess air over that needed to oxidise the carbon and hydrogen in the fuel, the pages devoted to this are especially appropriate.

The chapter on explosion and the explosion engine (which is a commendable term for the internal combustion engine) is necessary even in a work devoted to fuel, and the elementary relations between pressure, volume, and temperature in an expanding gas are introduced for the purpose of bringing out the use of fuel in such engines. It would be unfair to expect more thermodynamics in a work of this kind, and the reader must look elsewhere for a thorough treatment of the cycles, etc. It is our pleasure to commend this as an admirable book, quite up to date, and we have nothing to criticise in regard to accuracy, and but little on the score of insufficiency. Dr. Brislee has well kept in mind the actual needs of the practical chemist, who will find it a valuable aid, and the student will welcome it as something better than the dry-as-dust text-book.

(2) Whatever we may think of the commercial future of the Diesel engine, it is certainly the most efficient heat engine considered from a thermodynamic point of view. With the high compression employed, it confirms in a remarkable degree the theory of efficiency based upon the compression ratio. The commercial efficiency however is quite another thing, and notwithstanding the commendable faith of the author and the inventor

(who contributes an introduction), we think that many may conclude to reserve judgment for the present. The book is an *ex parte* statement of the merits of the engine, and we are inclined to think that the author has somewhat overstated his case. It is, however, a very readable work, dealing as it does with much that is new and which has an element of originality and novelty doubly welcome in works dealing with heat engines. Much of it is given up to interesting mechanical detail of engines actually constructed, and those who appreciate the mechanical difficulties incident to high compression and temperature will admire the ingenuity displayed in overcoming the troubles that would otherwise prevent the extensive adoption of the engine. And to a great extent the difficulties for small engines have been overcome to a degree which the reader will appreciate.

After an outline of the various cycles and efficiencies of heat engines, the action and working of the Diesel engine is described. Apparently experience does not yet point to the exclusive adoption of either the two- or four-cycle engine, but it is stated that for powers up to 600 or 700 horse-power the four-cycle engine will be employed for land purposes, and above that power the two-cycle. But perhaps the chief interest in the engine centres in its use for marine propulsion, and the latter half of the book is devoted to this application. With a fuel consumption of about half a pound per horse-power, it becomes a serious rival to the steam engine. Nor does the fuel consumption per horse-power increase for partial loads to such an extent as with steam engines according to figures quoted. The saving of space, always of importance on board ship, will necessarily depend upon the horse-power per cylinder of the engine, but notwithstanding the auxiliaries required in the form of air compressors for injecting the fuel and those installed for scavenging in the two-cycle engine, a considerable saving of space otherwise taken up by boilers might be expected. The issue of this book is timely, coming as it does so soon after the arrival of the Diesel-engined vessel *Selandia* in the Thames while we were in the midst of a coal strike.

(3) To deal with the numerous papers read before the American Institute of Chemical Engineers which are recorded in this volume would take us too far, for they cover a wide range of subjects embraced under the generic title of "chemical engineering." The president, Mr. McKenna, contributes an interesting paper on the evolution of Portland cement processes, in which the stupendous change brought about by the introduction of the rotary kiln is shown, both by the amount of cement made and its quality. Those who recall the days of the bottle kiln in the United States, with its intermittent operation, can appreciate the advantages of the rotary kiln, with its continuous process and uniform product, as used in the great cement works of that country. The quality and price of the Portland cement thus made are such as to enable it to compete successfully with "natural" (or "Rosendale") cement, when the lower tensile strength of these latter cements is considered. But perhaps even more interesting is the conversion of the slag heaps from blast furnaces into cement, which has been rendered possible by the high heat of the rotary kiln. It is stated that the manufacture of cement by the United States Steel Company is so large that it is rapidly becoming the largest factor in the business. The education of the chemical engineer is made the subject of a report by a committee. One observation bearing upon technical education in the United States and Germany is worth recording, viz., that "wits" are worth more than technical knowledge generally, and "that too much effort is devoted in the schools to training the mind in a philosophical way, and too little in training what we are to call the wits."

Incandescent lamp manufacture is treated by Mr. Myers in a paper describing the manipulation of refractory elements. These refractory elements, particularly tungsten, are employed for the reason that the intensity of the light emitted varies as the twelfth power of the temperature, while the energy supplied varies only as the fifth power, so that better efficiency can be obtained from a substance that can be burned at high temperatures. Carbon has the disadvantage that the vapour tension resulting at high temperatures is such that the operating temperature must be reduced to such a point that the efficiency is less than half that of the best metallic filament.

In a paper on the manufacture and industrial applications of ozone, Mr. Linder describes the Berthelot process used for the commercial production of this gas. Electric ozonisers produce ozone theoretically in direct proportion to the wattage of the discharge per unit of air ozonised, but the destructive action of the heat on the ozone makes the production less. It is only at about 8000 to 10,000 watts that the production of ozone becomes economical. The author believes that ozone will ultimately supersede formaldehyde in hospitals as a disinfecting agent, as recent experiments have shown it to be so suitable for the purpose. Experiments have shown that milk, cream, and butter can be completely sterilised, also other articles subject to decay. A paper on the loss in coal due to storage of (1) change in calorific value, (2) change in weight, and (3) tendency to disintegrate by slacking, gives the results of experiments from which it appears that coal of the kind tested (Illinois) rapidly reduces in size of lump with time. The change in calorific value was in all cases less than 2 per cent., and in one sample only 0·38 per cent. A number of other papers make up the volume, among which are nitric acid manufacture and sewage disposal.

(4) On this sheet, measuring 40 × 30 inches, Mr. Marsh has plotted diagrams for designing and checking members of reinforced concrete under direct compression, according to the rules laid down in the second report of the joint Committee appointed by the Royal Institute of British Architects and the London County Council draft regulations. By means of the diagrams, it is possible to design the column or strut for a total load with an assigned ratio of longitudinal reinforcement, and to obtain the appropriate hoop reinforcement. The diagrams will thus prove valuable for engineers designing compression members in reinforced concrete, and the only criticism that might be made would be the somewhat bulky form of the sheet. As the results of using the diagram would be in accordance with the above regulations, its utility ought to be quickly recognised by busy engineers.

(5) The introduction of electric and electro-pneumatic signalling arrangements on railways has given rise to a special branch of engineering, and it is to the engineers and students engaged in that department that Mr. Lewis addresses this volume. It will not appeal to engineers generally, though there is much ingenuity displayed in the design of modern signal systems which would attract a man with a mechanical turn of mind. The book is illustrated by excellent drawings, and the descriptive matter is well chosen. The author is lecturer on railway signalling at the Glasgow and West of Scotland Technical College, and is on the staff of the Caledonian Railway.

KAINOZOIC STRATIGRAPHY.

Traité de Géologie. By Prof. E. Haug. II., Les Périodes géologiques. Fascicule 3. Pp. iv + 1397–2024. (Paris: Armand Colin, 1908–1911.) Price 11 francs.

THE third fascicule of Prof. Haug's "Traité de Géologie" completes this valuable text-book with an account of the post-Cretaceous formations. The author's treatment of the subject, as in the previous parts, is marked by the special importance given to the varying bathymetric conditions under which different parts and areas of a formation have been laid down. The present volume is also of interest as it presents a modern French classification of the post-Cretaceous rocks. Prof. Haug does not use the term Kainozoic, and does not adopt any one term for these formations. He divides the post-Cretaceous time into three eras: the Nummulitic, the Neogene, and the Quaternary. He has abandoned the generally accepted five periods, and rejects Lyell's nomenclature altogether. British geologists will probably not follow this course unless the reasons for the change are quite convincing.

The Nummulitic and the Neogene are grouped together by Prof. Haug as the Tertiary, and both its lower and upper limits are ill-defined. He includes the Montian in his Nummulitic, and he explains its rich fauna of Cretaceous bryozoa and brachiopoda in the Tuffeau de Ciply as fossils derived from older limestones. As the Danian is left in the Cretaceous, the author admits an imperceptible stratigraphical boundary between the Cretaceous and the Nummulitic, in spite of the sudden change of fauna. Both the two divisions which Prof. Haug refers to the Tertiary he divides into three sections. His Eo-Nummulitic includes the Montian, with the Thanetian and the Londonian, of which the typical deposits are the Lower London Tertiaries. The Meso-Nummulitic ranges from the Lutetian to the Ludian, the section above the Barton clay. He rejects the Priabonian as a widespread horizon, and appears, on p. 1475, to limit it to the Alps, though he subsequently accepts it in North Africa; and its presence with other Nummulitic rocks in Cyrenaica, as shown since the publication of the volume, renders necessary the alteration of the statement (p. 1503) that there is no vestige of the Nummulitic sea between Egypt and Tunisia. The Neo-Nummulitic is practically the Lower Oligocene, and Prof. Haug quotes Tongrian and Oligocene as synonyms.

The three sections of the Nummulitic are subdivided into ten divisions, and the author conveniently gives the founder, etymology, and date of the name of each. The classification of the Nummulitic is based mainly on the foraminifera, and though Prof. Haug remarks that it may appear somewhat paradoxical to attach such weight to these primitive organisms, they are certainly among the most convenient fossils in the correlation of the Lower Kainozoic horizons.

The Neogene group Prof. Haug divides into three sections, and owing to the great importance of their representatives in the Mediterranean area, he calls them the Eo-Mediterranean, Meso-Mediterranean, and Neo-Mediterranean (p. 1607).